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# मानक

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IS 10779 (1984): Reference Coupler for the Calibration of Earphones Used in Audiometry [LITD 7: Audio, Video and Multimedia Systems and Equipment]



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“Knowledge is such a treasure which cannot be stolen”



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*Indian Standard*



# SPECIFICATION FOR REFERENCE COUPLER FOR THE CALIBRATION OF EARPHONES USED IN AUDIOMETRY

(IEC Title : IEC Provisional Reference Coupler for the  
Calibration of Earphones Used in Audiometry)

## National Foreword

This Indian Standard, which is identical with IEC Pub 303 (1970) 'IEC provisional reference coupler for the calibration of earphones used in audiometry', issued by the International Electrotechnical Commission (IEC), was adopted by the Indian Standards Institution on the recommendation of Acoustics Sectional Committee and approved by the Electronics & Telecommunication Division Council.

## Cross Reference

In this Indian Standard, the following International Standards are referred to. Read in their respective places the following :

<i>International Standard</i>	<i>Indian Standard</i>
ISO/R 389 Standard reference zero for the calibration of puretone audiometers	IS : 4755-1968 Reference zero for the calibration of pure-tone audiometers (Technically equivalent)
IEC Pub 177 Pure tone audiometers for general diagnostic purposes	IS : 9098-1979 Specification for pure-tone audiometers (Technically equivalent)

Adopted 15 October 1984

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## 1. Scope

This Report describes an interim reference coupler for loading an earphone with a specified acoustic impedance, when calibrating audiometers, in the frequency range of 125 Hz to 8 000 Hz.

The sound pressure developed by an earphone is not, in general, the same in the coupler as in a person's ear. However, the IEC recommends its use as a simple and ready means for the exchange of specifications on audiometers and for the calibration of earphones used in audiometry.

## 2. Definition

### 2.1 Coupler

A coupler is a cavity, of predetermined shape and volume, which is used for the testing of earphones in conjunction with a calibrated microphone adapted to measure the pressure developed within the cavity (IEV 08-30-020).

## 3. Construction

### 3.1 General

The coupler, shown in Figure 1, page 10, shall be made of a non-magnetic material, such as brass. The coupler consists essentially of a cylindrical cavity whose reactance is that of a volume defined in Sub-clause 3.2. The base of the cylindrical cavity is usually formed by the diaphragm of a microphone of high mechanical impedance. The microphone is also used to measure the sound pressure in the coupler. The walls of the cavity should be sufficiently rigid that flexural vibration does not affect the output of the microphone.

### 3.2 Critical dimensions

The critical dimensions (see Figure 1) of the coupler are those which determine the shape and volume of the cavity terminated by a condenser microphone, the capillary leak, the upper edge (lip) and the 45° angle.

3.2.1 The nominal effective acoustic volume  $V$  shall be equal to:

$$V = 5.78 \pm 0.08 \text{ cm}^3$$

3.2.2 The diameter  $d_1$  shall be equal to:

$$d_1 = 23.825 \pm 0.015 \text{ mm } (0.938 \pm 0.0006 \text{ in})$$

3.2.3 Diameter  $d_2$  shall be equal to:

$$d_2 = 18.55 \pm 0.10 \text{ mm } (0.730 \pm 0.004 \text{ in})$$

and the height  $l_2$  shall be equal to:

$$l_2 = 1.95 \pm 0.05 \text{ mm } (0.077 \pm 0.002 \text{ in})$$

3.2.4 The angle defining the slope of the external part of the coupler shall be equal to:

$$45 \pm 5^\circ$$

3.2.5 The height  $h$  of the coupler is calculated according to the following formula:

$$h = \frac{V - v - v_2}{\frac{1}{4} \pi d_1^2}$$

where:

- $V$  is the nominal effective acoustic volume
- $v$  is the equivalent acoustic volume of the microphone
- $v_2$  is the volume of the cavity of the microphone, given by:

$$v_2 = \frac{1}{4} \pi d_2^2 \cdot l_2$$

*Note.* — It is recommended that a value of  $h$  be selected from the table below, according to the value of the equivalent acoustic volume of the microphone.

Equivalent acoustic volume of the microphone $v$ (cm <sup>3</sup> )	Height of the coupler	
	$h$	Unit
$0.00 < v < 0.05$	$11.72 \pm 0.05$ $0.461 \pm 0.002$	mm in
$0.05 < v < 0.10$	$11.62 \pm 0.05$ $0.457 \pm 0.002$	mm in
$0.10 < v < 0.15$	$11.50 \pm 0.05$ $0.453 \pm 0.002$	mm in
$0.15 < v < 0.20$	$11.39 \pm 0.05$ $0.448 \pm 0.002$	mm in

3.2.6 ISO Recommendation R389, Standard Reference Zero for the Calibration of Pure-tone Audiometers, gives reference sound pressure level values for five different earphone-coupler combinations. Two of these combinations use the NBS 9A coupler. IEC Publication 177, Pure Tone Audiometers for General Diagnostic Purposes, refers to ISO Recommendation R389. The forthcoming supplement to this ISO Recommendation gives the audiometric zero for a number of earphones as the reference equivalent sound pressure level in the type 9A coupler.

If the coupler described in this Report is constructed with a fixed value of  $h + l_2 = 13.41 \pm 0.025$  mm ( $0.528 \pm 0.001$  in) regardless of the equivalent volume of the microphone, then the coupler will be identical with the NBS 9A coupler. The nominal effective acoustic volume of the Type 9A coupler is:

$$V = (5.64 + v) \text{ cm}^3$$

3.3 *Calibrated pressure microphone*

The internal shape of the base of the coupler corresponds to that of certain commercial microphones which can be employed to form that base. Other microphones can be used provided that the dimensions and stipulated volume are preserved, e.g. by using an adaptor

The microphone used shall have a large mechanical impedance, the equivalent volume being less than 0.2 cm<sup>3</sup> of air, at frequencies between 125 Hz and 8 000 Hz. There shall be an effective seal between the coupler and the microphone achieved by using a suitable material, e.g. grease.

Any obstruction in the static pressure equalization device of the microphone should be avoided.

### **3.4**    *Static pressure equalizer*

To equalize the static air pressure inside the coupler cavity with the external atmospheric pressure, a hole of diameter 0.6 mm (0.024 in) is drilled into the coupler. A wire of diameter 0.4 mm (0.016 in) is inserted into the hole.

A glass capillary tube may also be used for pressure equalization, in which case, care must be taken to seal the tube along its complete length in such a way that air leakage occurs only through the inner bore. The sound pressure difference, developed by a given voltage at the earphone terminals with the hole plugged or left open should not be greater than 0.2 dB at any frequency between 100 Hz and 10 000 Hz.

### **3.5**    *Coupling of earphone to coupler*

The cap of the earphone being calibrated rests on the upper edge, or lip, with a coupling force equal to the weight of the earphone plus a force, supplied either by a weight or a spring, of between 4 N and 5 N (see Figure 2, page 12). Note that the earphone does not rest on the sloping sides of the coupler but only on the edge indicated as "lip" in Figure 2.

In the case of earphones with a hard earcap, a thin film of sealing material or thin soft rubber ring should be used on the lip in order to produce an effective seal between the earphone and the upper edge of the coupler.

### **3.6**    *Calibration of the assembly*

The calibration of the **assembly is defined** as the calibration of the pressure microphone.

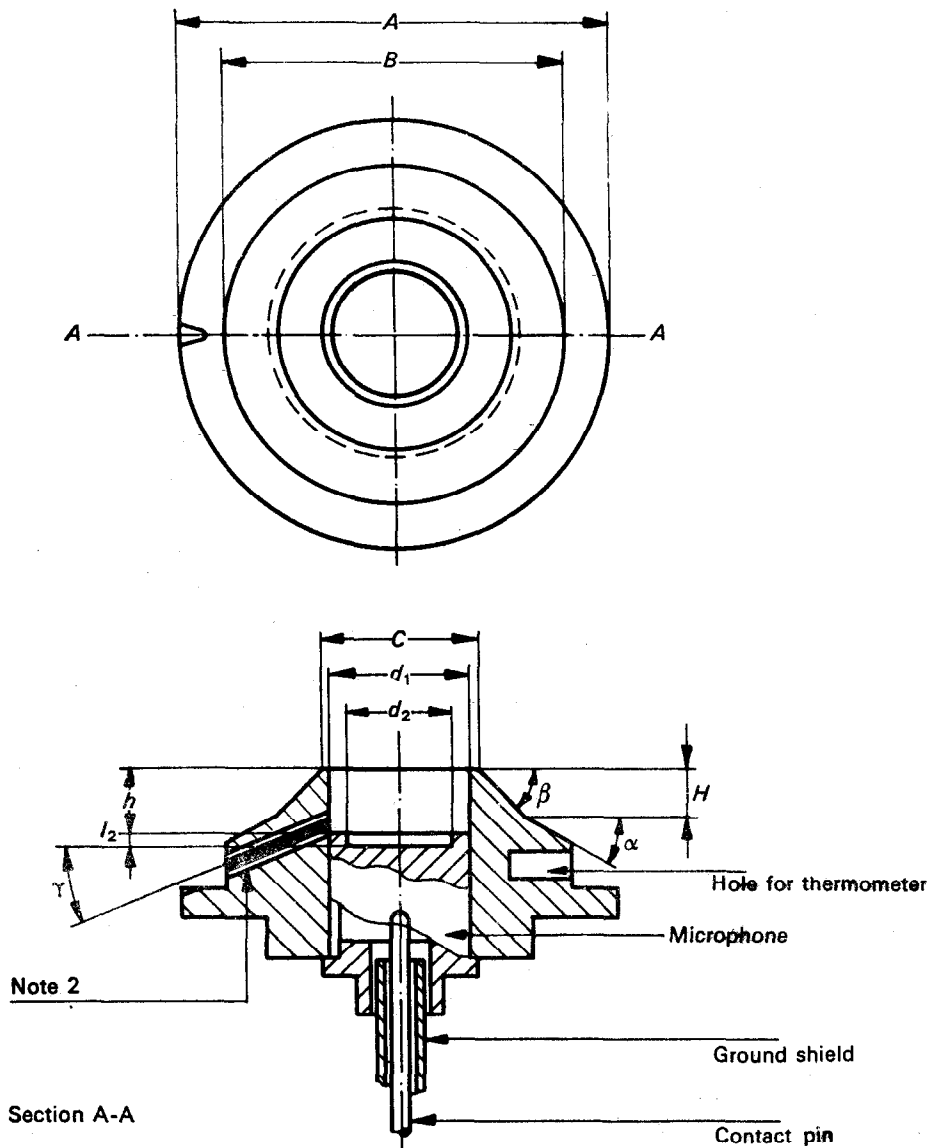


FIG. 1. — Coupler dimensions.



	mm	in	Remarque Remark
<i>A</i>	73	2.874	Note 1
<i>B</i>	57.2	2.252	
<i>C</i>	$25.27 \pm 0.13$	$0.995 \pm 0.005$	
<i>d</i> <sub>1</sub>	$23.825 \pm 0.015$	$0.938 \pm 0.0006$	
<i>d</i> <sub>2</sub>	$18.55 \pm 0.10$	$0.730 \pm 0.004$	
<i>l</i> <sub>2</sub>	$1.95 \pm 0.05$	$0.077 \pm 0.002$	Paragraphe 3.2.5 Sub-clause 3.2.5
<i>h</i>			
<i>H</i>	$7.5 \pm 0.1$	$0.295 \pm 0.004$	Note 1

	Degrees	Remark
$\alpha$ $\beta$ $\gamma$	$25 \pm 5$ $45 \pm 5$ 25	Note 1

*Notes 1.* — Due to an oversight in the preparation of the draft on which this Report was based, tolerances on the dimensions *C*, *H* and  $\alpha$  were omitted from Figure 1.

So as not to delay publication of the Report, the Chairman of TC 29, Mr. L. Batchelder, has approved the insertion of figures given above, pending their formal approval by National Committees at a later date.

2. — Capillary tube contoured to cavity.

Bore 0.60 mm (0.024 in) and wire 0.40 mm (0.016 in). See Sub-clause 3.4.

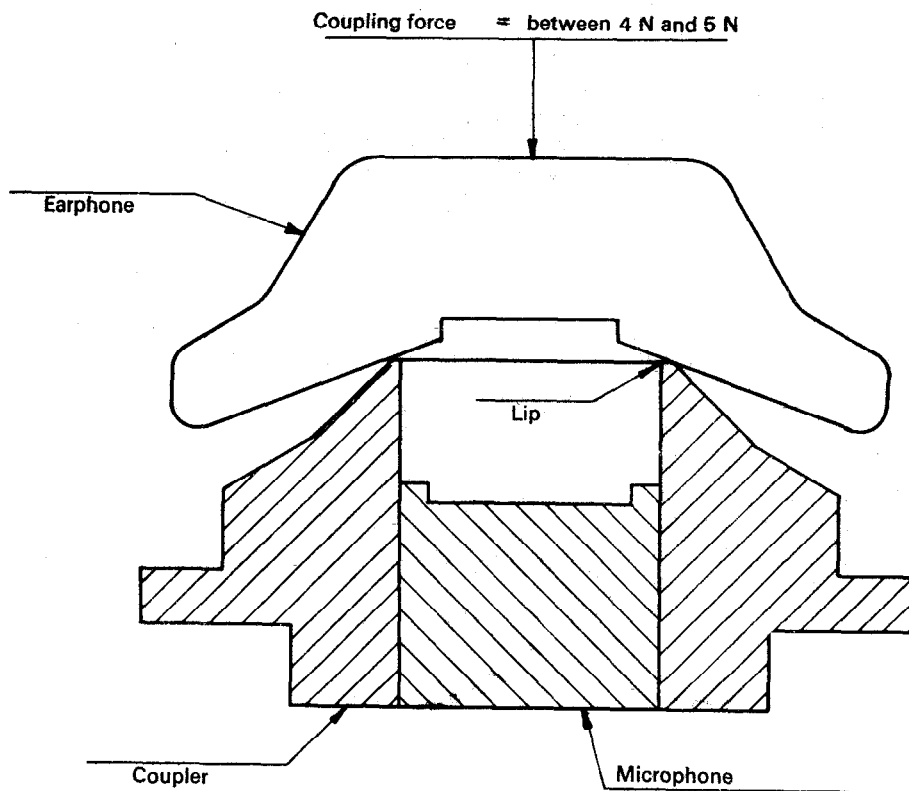


FIG. 2. — Coupling of earphone to coupler.